TITLE OF THE INVENTION

IMAGE DISPLAY DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image display device, and more particularly to an image display device which is referred to as an active matrix type image display device, for example.

2. Description of the Related Art

For example, the active matrix type liquid crystal display device includes, in the inside of a panel thereof, gate signal lines which supply scanning signals to a pixel group consisting of respective pixels which are arranged in parallel in one direction and drain signal lines which supply video signals to the respective pixels to which the scanning signals are supplied.

In each pixel, a switching element which is operated in response to supplying of the scanning signal, a pixel electrode to which signals from the drain signal lines are supplied through the switching element, and a counter electrode which generates an electric field for controlling optical transmissivity of liquid crystal between the pixel electrode and the counter electrode are formed.

The supply of the scanning signals to the gate signal lines and the supply of the video signals to the drain signal lines are respectively performed by a scanning signal drive circuit

and a video signal drive circuit each of which is constituted of semiconductor devices which are mounted on a surface of one of substrates of a panel on which the gate signal lines and the drain signal lines are formed (hereinafter, these circuits being simply referred to as signal drive circuits in some cases).

Here, each one of the scanning signal drive circuit and the video signal drive circuit is constituted of a plurality of semiconductor devices. Further, the signal lines which are arranged adjacent to each other are formed into a group and one semiconductor integrated device is allocated to each group.

In this case, the plurality of respective semiconductor devices which constitute the video signal drive circuit, for example, are configured such that data are transmitted through a data transfer signal line between each semiconductor device and another neighboring semiconductor device whereby the cumbersomeness of the constitution which supplies signals independently to respective semiconductor devices is obviated.

BRIEF SUMMARY OF THE INVENTION

First of all, inventors of the present invention have found out a phenomenon in which during a manufacturing process of the image display device having such a constitution, a spark attributed to static electricity is generated between the data transfer signal line and the drain signal line which is arranged adjacent to the data transfer signal line and these lines are

disconnected.

When the inventors pursued a cause of this phenomenon, a following fact is found out. That is, during the manufacturing, the substrate repeats attraction and peeling-off thereof with respect to a metal-made fixing portion which supports the substrate so that static electricity of high voltage which is referred to as so-called peel-off charge is applied to the whole substrate.

In this case, there lies large difference between an area for respective data transfer signal lines which are formed as a group of data transfer signal lines and an area for respective drain signal lines which are formed as a group of drain signal lines, for example, adjacent to the group of data transfer signal lines. This is because that while the group of data transfer signal lines is formed in the periphery of the substrate, the group of drain signal lines extend traversing the panel.

Accordingly, the large difference is generated between a charge quantity of static electricity which is charged to the group of data transfer signal lines and a charge quantity of static electricity which is charged to the group of drain signal lines and hence, a spark is liable to easily occur between the data transfer signal line and the drain signal line which are arranged adjacent to each other.

Further, during the manufacturing process, when the data transfer signal lines are isolated every other line and the drain

signal lines temporarily adopt the constitution in which the drain signal lines are connected to each other using a common line, while the potential of the drain signal lines rapidly approaches 0, the potential of the data transfer signal lines is held at a high level.

Accordingly, a potential difference of high voltage is generated between the data transfer signal lines and the drain signal lines and hence, a spark is liable to occur between the data transfer signal line and the drain signal line which are arranged adjacent to each other.

The present invention has been made in view of such circumstances and it is an object of the present invention to provide an image display device which, when one group of signal lines and another group of signal lines which differ in length from one group of signal lines are arranged adjacent to each other, can prevent the disconnection attributed to static electricity generated by the occurrence of a spark between the signal line of one group of signal lines and the signal line of another group of signal lines which are arranged adjacent to each other.

To briefly explain the summary of typical inventions out of the inventions disclosed in this specification, they are as follows.

Means 1.

According to the image display device of the present

invention, for example, a first signal line group constituted of a plurality of first signal lines which are arranged in parallel and a second signal line group constituted of a plurality of second signal lines which are arranged in parallel in a region adjacent to the group of first signal lines are formed on a substrate, and a dummy line is arranged between the first signal line group and the second signal line group.

Means 2.

The image display device according to the present invention is, for example, on the premise of the constitution of means 1, characterized in that both ends of the dummy line are not connected to other signal lines.

Means 3.

The image display device according to the present invention is, for example, on the premise of the constitution of means 1, characterized in that the dummy line has each one portion thereof connected to the first signal lines and the second signal lines which are arranged adjacent to the dummy line.

Means 4.

The image display device according to the present invention is, for example, on the premise of the constitution of any one of means 1 to 3, characterized in that the dummy lines is constituted of a plurality of lines which are arranged in parallel.

Means 5.

The image display device according to the present invention is, for example, characterized in that a drive circuit which supplies signals to respective pixels in an image display part of a substrate through signal lines is formed outside the image display part, the drive circuit is constituted of a plurality of semiconductor devices, these respective semiconductor devices are configured such that data are supplied between these respective semiconductor devices and other semiconductor devices which are arranged adjacent to these respective semiconductor devices through data transfer signal lines, and a dummy line is formed between the signal lines and the data transfer signal lines.

Means 6.

The image display device according to the present invention is, for example, on the premise of the constitution of means 5, characterized in that the signal lines are drain signal lines which supply video signals to respective pixels, and the drive circuit constitutes a video signal drive circuit.

Means 7.

The image display device according to the present invention is, for example, on the premise of the constitution of means 5, characterized in that the signal lines are gate signal lines which supply scanning signals to respective pixels, and the drive circuit constitutes a scanning signal drive circuit.

Means 8.

The image display device according to the present invention is, for example, on the premise of the constitution of means 5, characterized in that the signal lines which are arranged adjacent to each other are formed into a group, the signal lines which are formed into each group are directed in the converging direction outside the image display part and are connected to the respective semiconductor devices, and data transfer signal lines which connect between the semiconductor device and another semiconductor device arranged adjacent to the former semiconductor device are formed such that the data transfer signal lines wrap around at the image display part side than these respective semiconductor devices.

Means 9.

The image display device according to the present invention is, for example, on the premise of the constitution of means 5, characterized in that the dummy line is connected with the signal lines which are arranged adjacent to the dummy lines.

Means 10.

The image display device according to the present invention is, for example, on the premise of the constitution of means 9, characterized in that the connection between the dummy lines and the signal lines are established at the image display part side.

Means 11.

The image display device according to the present invention

is, for example, characterized in that a pair of electrodes are formed on each pixel within an image display part of a substrate, one of the pair of electrodes includes a counter electrode to which a counter voltage supply signal which becomes the reference with respect to signals supplied to another electrode of the pair of electrodes is supplied, a drive circuit which supplies signals to the respective pixels through signal lines is formed outside the pixel display part, the drive circuit is constituted of a plurality of semiconductor devices, a counter voltage supply signal line which supplies counter voltage supply signals to the counter electrode is formed on a region between the semiconductor device and another semiconductor device which is arranged adjacent to the former semiconductor device, and a dummy line is arranged between the signal lines and the counter voltage supply signal line.

The present invention is not limited to the above-mentioned constitutions and various modifications are conceivable without departing from the scope of technical concept of the present invention.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Fig. 1 is a plan view of an essential part showing one embodiment of an image display device according to the present invention and is also a view corresponding to a portion of a frame A in Fig. 3;

Fig. 2 is a plan view showing one embodiment of the whole structure of the image display device according to the present invention;

Fig. 3 is a plan view showing another embodiment of the whole structure of the image display device according to the present invention and is also a view obtained by simplifying Fig. 2;

Fig. 4 is a comparison view for showing an advantageous effect of the present invention;

Fig. 5 is a view showing a product to which the present invention is applied and is also a plan view corresponding to Fig. 1;

Fig. 6 is a view showing a product to which the present invention is not applied and is also a plan view corresponding to Fig. 4;

Fig. 7 is a plan view of an essential part showing one embodiment of the image display device according to the present invention;

Fig. 8 is a plan view of an essential part showing one embodiment of an image display device according to the present invention;

Fig. 9 is a plan view of an essential part showing one embodiment of the image display device according to the present invention;

Fig. 10 is a plan view of an essential part showing one

embodiment of the image display device according to the present invention; and

Fig. 11 is a plan view of an essential part showing one embodiment of the image display device according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of an image display device of the present invention are explained in conjunction with drawings. In the explanation made hereinafter, the image display device is explained by taking a liquid crystal display device, for example, as an example.

Embodiment 1.

<< Whole constitution >>

Fig. 2 is a plan view showing one embodiment of a liquid crystal display device according to the present invention, wherein a portion thereof is shown in a form of an equivalent circuit.

In the drawing, there are provided a pair of transparent substrates SUB1, SUB2 which are arranged to face each other with liquid crystal sandwiched therebetween, wherein the liquid crystal is sealed by a sealing material SL which also performs a function of fixing another transparent substrate SUB2 to one transparent substrate SUB1.

On a liquid-crystal-side surface of one transparent

substrate SUB1 surrounded by the sealing material SL, gate signal lines GL which extend in the x direction and are arranged in parallel in the y direction and drain signal lines DL which extend in the y direction and are arranged in parallel in the x direction are formed. Regions surrounded by respective gate signal lines GL and respective drain signal lines DL constitute pixel regions and a mass of these pixel regions in a matrix array constitute a liquid crystal display part AR.

Further, on respective pixel regions which are arranged in parallel in the x direction, a common counter voltage signal line CL which runs in the inside of respective pixel regions is formed. This counter voltage signal line CL constitutes a signal line which is served for supplying a voltage which becomes reference with respect to video signals to counter electrodes CT in each pixel region described later.

In each pixel region, a thin film transistor TFT which is driven by scanning signals from one-side gate signal line GL and a pixel electrode PX to which the video signals from one-side drain signal line DL are supplied through the thin film transistor TFT are formed.

The pixel electrode PX generates an electric field between the pixel electrode PX and the counter electrode CT which is connected to the counter voltage signal line CL and the optical transmissivity of the liquid crystal is controlled in response to the electric field.

Respective one ends of the gate signal lines GL extend beyond the sealing material SL and extended ends constitute terminals GLT to which output terminals of a scanning signal drive circuit V is connected. Further, to input terminals of the scanning signal drive circuit V, signals from a printed circuit board (not shown in the drawing) which is arranged outside a liquid crystal display panel are inputted.

The scanning signal drive circuit V is constituted of a plurality of semiconductor devices, wherein a plurality of gate signal lines GL which are arranged adjacent to each other are formed into a group and one semiconductor device is allocated to each group.

In the same manner, respective one ends of the drain signal lines DL extend beyond the sealing material SL and extended ends constitute terminals DLT to which output terminals of a video signal drive circuit He is connected. Further, to input terminals of the video signal drive circuit He, signals from a printed circuit board (not shown in the drawing) which is arranged outside a liquid crystal panel are inputted.

The video signal drive circuit He is also constituted of a plurality of semiconductor devices, wherein a plurality of drain signal lines DL which are arranged adjacent to each other are formed into a group and one semiconductor device is allocated to each group.

Further, the counter voltage signal lines CL have

right-side end portions thereof in the drawing commonly connected and a connection line extends beyond the sealing material SL, and an extended end of the connection line constitutes a terminal CLT. A voltage which becomes the reference with respect to the video signals is supplied from the terminal CLT. The respective gate signal lines GL are sequentially selected one after another in response to the scanning signal lines from the scanning signal drive circuit V.

Further, to respective drain signal lines DL, the video signals are supplied at the selection timing of the gate signal lines DL from the video signal drive circuit He.

<< Signal drive circuit >>

While Fig. 3 is a plan view of the liquid crystal display device in the same manner as Fig. 2, this drawing shows the constitution in which the scanning signal drive circuit V is constituted of a plurality of semiconductor devices, and these semiconductor devices are arranged in parallel in the y direction on the transparent substrate SUB1 and, at the same time, the video signal drive circuit He is constituted of a plurality of semiconductor devices and these semiconductor devices are arranged in parallel in the x direction on the transparent substrate SUB1.

Further, the drain signal line DL which is pulled out from the liquid crystal display part AR side is formed in a conversing manner directing to one semiconductor device together with other

drain signal lines DL which are arranged adjacent to each other and are formed into a group.

This is because that a pitch of bumps of the semiconductor device to which respective drain signal lines DL are connected is smaller than a pitch of respective drain signals lines DL in the liquid crystal display part AR.

In the same manner, the gate signal line GL which is pulled out from the liquid crystal display part AR side is formed in a conversing manner directing to one semiconductor device together with other gate signal lines which are arranged adjacent to each other and are formed into a group.

Further, in this embodiment, among the semiconductor devices which constitute the video signal drive circuit He, a data transfer signal line DTL which connects one semiconductor device and another semiconductor device which is arranged adjacent to the former semiconductor device is formed on the transparent substrate SUB1.

The signals are sequentially supplied to respective semiconductor devices through the data transfer signal line DTL thus avoiding the cumbersomeness of supplying signals independently to respective semiconductor devices.

In the same manner, also with respect to the semiconductor devices which constitute the scanning signal drive circuit V, the data transfer signal line DTL which connects one semiconductor device and another semiconductor device which is

arranged adjacent to the former semiconductor device is formed on the transparent substrate SUB1.

<< Arrangement relationship between drain signal lines and data transfer signal lines >>

Fig. 1 is a view showing the detail of the arrangement relationship between the drain signal lines DL and the data transfer signal lines DTL and Fig. 3 is an enlarged view of a portion corresponding to a rectangular frame A shown in Fig. 3.

In the drawing, the drain signal line DL (R) group at the right side in the drawing is directed to the semiconductor device arranged at the right side in the drawing although not shown in the drawing and hence, they are formed to run having two bent portions, for example. That is, each drain signal line DL which extends from the liquid crystal display part AR side has the direction thereof changed in the direction that the drain signal lines DL are converged to each other at the first bent portion and subsequently runs while changing the direction thereof to the bump side to be connected to the semiconductor device directly by the next bent portion.

In the same manner, the drain signal line DL (L) group at the left side in the drawing is also formed such that the group runs while having two bent portions, for example, to direct the drain signal line DL (L) group to the semiconductor device arranged at the left side in the drawing although not shown in

the drawing.

Here, in this embodiment, respective bent portions of each drain signal line are configured to be positioned within a region where the sealing material SL is formed.

Then, a region in which the drain signal lines DL are not formed is formed between the drain signal line DL (R) group and the drain signal line DL (L) group which are directed in the different directions, that is, in the right and left directions, while the data transfer signal line DTL group which connects respective semiconductor devices arranged adjacent to the region are formed such that they wrap around the region.

The reason that the data transfer signal line DTL group is formed in such a roundabout manner is to reduce a width of the peripheral side of the transparent substrate SUB1 with respect to respective semiconductor devices which constitute the video signal drive circuit He, for example, so as to narrow a region which is referred to a so-called picture frame.

Accordingly, only a slight gap is formed between the drain signal line DL which is arranged at the side of the drain signal line DL group which is connected to each semiconductor device as a group and the data transfer signal line DTL which is arranged at the side of the data transfer signal line DTL group.

In this case, the large difference exists between a length of each drain signal line DL and a length of each data transfer signal line DTL. Accordingly, a charge quantity charged to the

drain signal line DL group due to the static electricity and a charge quantity charged to the data transfer signal line DTL group due to static electricity differ largely and hence, as shown in Fig. 4 which corresponds to Fig. 1, a spark SP occurs due to static electricity between the drain signal line DL and the data transfer signal line DTL which are arranged to adjacent to each other so that either one of the signal lines is disconnected.

Accordingly, in this embodiment, as shown in Fig. 1, in the above-mentioned gap, a so-called dummy line DLY is formed along the running direction of the drain signal line DL which is arranged at the side of the drain signal line DL group, for example. Here, the dummy line DLY implies a line which does not contribute to the signal transfer. In this embodiment, both ends of the dummy line DLY are not connected to any other lines.

Due to such a constitution, a spark can be generated between the drain signal line DL which is arranged at the side of the drain signal line DL group and the dummy line DLY which is arranged adjacent to the drain signal line DL and hence, the disconnection of the drain signal line DL can be prevented.

Further, a spark can be generated between the data transfer signal line DTL which is arranged at the side of the data transfer signal line DTL group and the dummy line DLY which is arranged adjacent to the data transfer signal line DTL and hence, the disconnection of the data transfer signal line DTL can be

prevented.

Here, in applying the present invention to an actual product, the constitution which corresponds to Fig. 1 is shown in Fig. 5, and the constitution which corresponds to the constitution shown in Fig. 5 and is not provided with the dummy line DLY is shown in Fig. 6.

Embodiment 2.

Fig. 7 is a view showing another embodiment of the image display device according to the present invention and corresponds to Fig. 1.

The constitution which makes this embodiment different from the constitution shown in Fig. 1 lies in that the dummy line DLY has a portion thereof electrically connected to the neighboring drain signal line DL through a connecting portion JK.

Due to such a constitution, the potential of the dummy line DLY can be set equal to the potential of the drain signal line DL which is positioned at the side of the drain signal line DL group and hence, the potential of the dummy line DLY can be made stable.

Accordingly, a spark attributed to static electricity can be surely generated at the dummy line DLY.

In this case, a line width of the drain signal line DL is generally set smaller than a line width of the data transfer signal line DTL.

Further, it is preferable that a line width of the dummy line DLY is set to a value which is 3/4 to 5/4 of the line width of the drain signal line DL.

This provision is made to make the capacitance of the drain signal line DL which is electrically connected to the dummy line DLY approximate the capacitance of other drain signal line DL. Due to such a constitution, the luminance can be made uniform.

Embodiment 3.

Fig. 8 is a view showing another embodiment of the image display device according to the present invention and corresponds to Fig. 7.

In the same manner as the embodiment shown in Fig. 7, although the dummy line DLY is connected to the drain signal line DL which is arranged adjacent to the dummy line DLY, the connecting portion JK is provided to an end portion at the liquid crystal display part AR side and is not provided at the peripheral side of the transparent substrate SUB1.

Due to such a constitution, the disconnection of the dummy line DLY by sparking occurs at a position close to the liquid crystal display part AR. Assuming that the disconnection of the dummy line DLY occurs at the peripheral side of the transparent substrate SUB1, there exists possibility that the so-called electrolytic corrosion is generated at the disconnected portion and the electrolytic corrosion progresses from the disconnected portion.

Further, a side of the dummy line DLY which is close to the liquid crystal display part AR is covered with the sealing material SL thus ensuring a state in which the electrolytic corrosion is hardly generated from the side even when the disconnection is generated.

Embodiment 4.

Fig. 9 is a view showing another embodiment of the image display device according to the present invention and corresponds to Fig. 8.

The constitution which makes this embodiment different from the embodiment shown in Fig. 8 lies in that when the dummy line DLY shown in Fig. 8 is used as a first dummy line DLY1, a second dummy line DLY2 is provided adjacent to the first dummy line DLY 1.

Further, the second dummy line DLY2 is connected to the first dummy line DLY1 at an end portion of the liquid crystal display part AR side.

Due to such a constitution, the function of the dummy line DLY is further strengthened.

Embodiment 5.

Fig. 10 is a view showing another embodiment of the image display device according to the present invention and corresponds to Fig. 9.

The constitution which makes this embodiment different from the embodiment shown in Fig. 9 lies in that the connection

of the second dummy line DLY2 with the first dummy line DLY1 is not made at the end portion side of the liquid crystal display part AR side but is made at one end of the peripheral side of the transparent substrate SUB1.

Due to such a constitution, even when the disconnection is generated at the second dummy line DLY2 by sparking, the electrolytic corrosion which is generated at such a portion must go through the first dummy line DLY1 to reach the drain signal line DL and hence, the propagation of the electrolytic corrosion becomes difficult structurally.

Embodiment 6.

Fig. 11 is a view showing another embodiment of the image display device according to the present invention and corresponds to Fig. 1.

The constitution which makes this embodiment different from the embodiment shown in Fig. 1 lies in that between respective semiconductor devices which constitute the video signal drive circuit He, there exist some portions where the above-mentioned data transfer signal line DTL is not arranged and the counter voltage signal line CL is arranged instead.

In this embodiment, the portion where the counter voltage signal line CL is arranged is shown. The counter voltage signal line CL is formed as a layer equal to the drain signal line DL, for example, and is formed as a layer (an upper layer) different from the counter electrode CL which extends to the liquid crystal

display part AR side by way of an insulation film.

Accordingly, the counter voltage signal line CL is electrically connected to the counter voltage CL through a contact hole CH formed in the insulation film. Here, since the drain signal line DL group is arranged around the counter voltage signal line CL, the above-mentioned drawback arises due to the difference in the charge quantity of static electricity between them. Accordingly, also in this embodiment, the dummy line DLY is provided between the counter voltage signal line CL and the drain signal line DL group.

It is needless to say that the technical concept described in the above-mentioned embodiments is also applicable to the specific constitution of the dummy line DLY in this embodiment.

The above-mentioned respective embodiments describe the constitutions which prevent the disconnection or the like attributed to the spark generated between the drain signal line DL and the data transfer signal line DTL which connects respective semiconductor devices of the video signal drive circuit He. However, it is needless to say that the disconnection or the like due to a spark generated between the gate signal line GL and the data transfer signal line which connects respective semiconductor devices of the scanning signal drive circuit V can be prevented by the constitution similar to the above-mentioned constitution.

Further, although the above-mentioned image display

devices have been explained by taking the liquid crystal display devices as examples, the present invention is applicable to so-called organic EL display devices, for example. This is because that the organic EL display device includes a pair of electrodes through an organic EL layer in the constitution of the pixel and has substantially the same constitution as the liquid crystal display device with respect to other constitutions.

As has been explained heretofore, according to the image display device of the present invention, when one signal line group and another signal line group which differs in length from one signal line group are arranged close to each other, the disconnection due to the static electricity caused by the spark generated between the signal line of one signal line group and the signal line of another signal line group which are arranged adjacent to each other can be prevented.